Tropical Fruits

Introduction

This document was prepared with the contributions and support of diverse groups related to the research, commercialization, and conservation of tropical fruits. The exchange of ideas was achieved through individual meetings and workshops with multidisciplinary working groups whose ideas were molded here. The document describes the areas in which the Tropical Fruits group at CIAT, in cooperation with national and international partners, will focus its research efforts to:

> *Improve the competitiveness of small tropical-fruit growers and service suppliers through information and technologies that result in sustainable practices and production systems, thus improving access to markets and increasing family incomes*

It is absolutely clear that the impact sought will be reached, not merely through an agenda imposed by research centers, but also through the use of participatory approaches, taking into account the demands of end users and partners. An approach of solving problems and realizing the potential of opportunities in the value chain will be the modus operandi of the agenda described below.

To multiply the impact of research, CIAT will work with other research organizations, educational entities, the private sector, and development organizations. The great diversity of fruits in Latin America (>1200 species) represents a significant challenge, but this is equalized or surpassed by opportunities. Hence, CIAT will not select the species for which to develop the below proposed thematic agendas. Instead, these will be defined by users in the countries where such knowledge is necessary.

Eco-efficient production systems

In this research area, we seek to understand mixed production systems so that they can be designed to reduce postharvest losses and the prevalence of pests and diseases, increase the system's resilience, and act strategically to mitigate climate change, thereby generating real income opportunities for farmers.

Problems and characteristics

Tropical fruits are grown in production systems that vary in ecological and socioeconomic complexity, ranging from monocultures to multispecies agroforestal systems, where large-scale farmers or investors may make minimal or million-dollar investments. Likewise, the technology levels used are also precarious, especially for minor crops for which, in many cases, available information does not exist. This means that small farmers depend on others to access planting materials; and provide information on crop management, postharvest management, and market information. Much of the technical assistance received for managing crop pests, diseases, and nutrition comes

from sales representatives of agrochemical companies.

Indeed, the current state of fruit production in Latin America and the Caribbean is worrying. The excessive use of pesticides means that food is not innocuous. The environmental footprint is also large, especially regarding use of water and air, soil conservation, and use of chemicals hazardous to human health. Postharvest losses are extremely high at 30% to 50%. Our knowledge of production systems overall (i.e., of agronomic, environmental, and socioeconomic aspects) is limited.

Responding to these challenges and opportunities

Some responses to these challenges and opportunities include:

- Cement the approach and develop expertise in production systems, using an agroecological focus.
- Foster the agricultural reconversion of the fruit-growing sector by seeking and developing alternatives to reduce the accumulation of harmful chemical residues in the environment and in the final products that reach the consumer.
- Study solutions to plant health problems of widespread incidence and distribution that cause heavy economic losses; such solutions include resistant germplasm and variations in production systems that will reduce incidence and thus negative effects on the environment.
- Design and recommend resilient production systems, using the best models of climate change available; such design would include the selection of species or varieties and the study of the distribution of fruit-crop pests and diseases.
- Develop indicators of eco-efficient production systems, taking into account the ecological footprint of fruit crops.
- Promote production systems that help mitigate and will adapt to climate change.

Use and analysis of fruit biodiversity

The Americas have the highest diversity of tropical fruits on the planet. Hence, in this thematic area, we seek to take advantage of such genetic diversity to improve existing production systems and consumer nutrition, and help farmers access markets.

Problems and characteristics

Fruit production, together with its genetic diversity, appears in production systems distributed in the lowland located as far-ranging as hot humid tropics to cold and dry uplands. This situation offers development opportunities to vulnerable populations in diverse ecological environments. Latin America and the Caribbean form the center of origin of more than 1200 species of fruits. Many of these contribute to income generation through local markets and others through export markets. However, urbanization and lack of financial resources for conserving germplasm, both *in situ* and *ex situ*, seriously threaten genetic diversity.

This threat is accentuated by the growing globalization of markets and trends towards specialization of export markets, endangering species survival and reducing the potential for development of other, minor, but very valuable fruit crops. The potential of genetic diversity to provide adaptation to pest and disease pressures, diversity in quality (nutritional value, appearance, flavor, and postharvest life), and capacity to adjust to climate change has not been explored, therefore demanding multi-institutional attention.

Responding to these challenges and opportunities
Some responses to these challenges and opportunities include:

- Develop efficient methodologies to evaluate germplasm resistant to pests and diseases, including the search for molecular tools or *in vitro* techniques to accelerate the identification of sources of resistance to major diseases.
- Develop methods for facilitating access to improved germplasm and for ensuring safe, fast, and economic diffusion of desirable germplasm.
- Develop a strategy to promote the characterization and use of genetic diversity to respond to the challenges of climate change.
- Understand the causes that promote consumption and differential use of selected germplasm.
- Study the functional and organoleptic properties of cultivated fruit species, considering both health benefits and market demands.

Access to equitable markets

In addition to their essential role in human nutrition, fruits represent a vehicle by which to generate income and rural development. Thus, in this agenda, CIAT will use mechanisms, and partner associations and entities to facilitate the development of new and existing markets and the access to these by small producers.

Problems and characteristics

Small producers must be able to access markets if tropical fruits are to realize their potential for alleviating poverty. The seasonal production of many tropical fruits imposes serious restrictions on the profitability of production, especially when production peaks saturate markets. This imposes limited negotiation power on small producers and a low or null cash flow for operations.

Market evolution and the development of large urban areas have made informal markets and galleries less attractive in developing countries. Quality standards demanded by national and regional markets are stimulating the implementation of more rigorous and sophisticated market conditions, both domestic and export.

As a result, small producers must improve the quality of their products, develop their power to negotiate, improve organizational and commercial structures, and increase their ability to penetrate new markets. Large buyers also need strategies to ensure the supply of quality products from small producers, and to adopt socially responsible decisions that will deploy small producers as regular suppliers.

Responding to these challenges and opportunities
Some responses to these challenges and opportunities include:

- Use participatory methodologies [e.g., Local Agricultural Research Committees (CIAL), Innovation Agents in Rural Agroindustry (GIAR), rapid market appraisal, mapping of results, and collaborative adaptive management], adjusting them duly to tropical fruits. Thus, new markets can be identified, competitiveness of producer associations improved, and capacity for innovation developed.
- Forge collaborative partnerships with the private sector and international nongovernmental organizations, whereby production chains of specific fruits can be analyzed to identify points for intervention, develop technologies to optimize production systems, and improve access to markets.

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